National Lynx Detection Protocol

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Purpose

A variety of means have been developed to detect lynx and other carnivores. The purpose of this protocol is to add reliability, efficacy, and representativeness to the process of lynx detection. Each element of the protocol has been designed to achieve this end.

Representativeness. While it can be argued that selective sampling (where one goes to the "best" places and samples) may provide detections at lower cost, the data generated using these methods is much less valuable. Non-representative surveys at best can provide simple occurrence data. Other more meaningful metrics: where lynx are present and absent, the habitat relationships of lynx, minimum viable population estimates, and current range all require representative sampling. Hair-pad methods were chosen because they allow sampling during the snow-free period, are durable, inexpensive, and lightweight. A lightweight, inexpensive sampling scheme which could be implemented in the summer was a necessity for representative sampling. Areas that are dangerous or away from roads will not be representatively sampled in the winter, and very expensive or high-maintenance detection stations can only be placed at a few locations. Representative sampling requires unbiased and uniform placement rules for the sample points. To this end, the protocol is grid-based and uses simple placement rules which can be applied to most landscapes.

Efficacy. Even if sampling is representative, if detection rates are too low, the method will fail the test of efficacy. To address this, we tested 5 commercial scent lures on wild lynx in Canada to determine which lure produced the highest detection rate. While all lures were "hit" by lynx, one lure, a combination of beaver castorium and catnip oil was twice as effective as the others. Additionally, we made use of transects

to sample lynx in Canada. Over a 2-4 week period, we had hits on nearly half (35/78 = 45%) of these 5-station line transects. Based on these results, we use line transects and the most effective lure.

Reliability. Reliability is largely a product of effective and representative sampling, but there are additional properties that a reliable survey protocol should have. It should be reliable in the sense that if applied, it will produce interpretable results. At the finest scale (traditionally the scent station but, in our design, the transect) if a lynx is present in the area, the probability of detection should be as constant as possible. This allows the proportion of occurrences to infer use. At a larger scale, we want to reliably state that, given a certain level of effort, we will have detections if lynx are present, and therefore a lack of detections indicates a lack of lynx.

At the fine scale, placing scent stations 100 m apart and perpendicular to the major slope produces a structure that will be encountered by lynx moving through the country and removes small-scale differences associated with station placement. At a broader scale, the protocol requires placing no fewer than 25 transects at a density of 1 transect per every 2 miles for a period of 2-4 weeks to ensure that an area is adequately sampled.

Details

Broad decisions concerning where to sample

Decisions as to where to sample are based primarily on the interest of the managers. If grids (25+ transects) were placed randomly within a major cover type, the grids themselves would be a representative sample of the cover type. A manager may, however, need information about lynx in a specific area, and can place grids preferentially. In broken habitat, such as forested areas separated by low elevation prairie, dry forest types or deciduous forests not thought to be lynx habitat, or lands which have been converted to agriculture, the sampling does not need to conform to a rectangular grid. All that is required is that the placement within the lynx habitat be at a density of about 1 transect per every 2 miles. An easy way to accomplish this is to put a large 2x2 mile grid across the landscape and use only those points which fall into habitat as the sample. In all cases the grid should start at a random location. Do not move the grid to get

the highest number of points in habitat. One approach that may work well is simply to use section boundaries as the grid. If these boundaries are not associated with vegetation changes, then they can be thought of as random. If, however, there are specific features that are generally associated with section boundaries, such as changes in forest age associated with "checkerboard" ownership patterns in the West, then section boundaries will not work, and you will need to start the grid at a random location.

As was mentioned above, managers can decide where to sample, but our recommendations are generally to sample in cover types and areas which there is some evidence of historical lynx occurrence. Maps of broad cover-types associated with historic lynx occurrence are available for the contiguous US. These cover-type maps, or local vegetation coverage, can serve as a guide for determining priority of survey efforts. We would caution that, early in the process, deciding *a priori* that an area cannot support lynx without detailed local knowledge, is not without risk. If grids are designed as a representative sample of a particular cover type, sampling within this cover type provides no information about any other cover type. There will always be this trade-off: tight stratification rules will presumably increase the efficacy, but they limit the inference. Additionally, this grid-based approach works best and is most efficient in areas where cover types are reasonably contiguous.

Exactly how you resolve the relative importance of these two properties: efficacy vs inference, and hence how you stratify your landscape prior to sampling, will largely be a function of local knowledge, priorities, and vegetation patterns. Two examples may provide insight into this process. In the Superior NF a question of primary importance is: Do we have any resident populations of lynx? To answer this question, the Superior will be looking to place grids in those areas where they have the most recent evidence of lynx occurrence and where the habitat appears to be most suitable. In the Okanogan NF, the presence of lynx in the area studied by Koehler and Brittell is not in question. The Okanogan, therefore is placing grids in areas where they have some information that lynx occur, and would like to gather more data concerning these lynx. They are not, therefore, necessarily placing the surveys in the "best" areas, as is the Superior, but they are still only surveying in-and-adjacent-to cool wet forest types.

In all cases, we recommend avoiding multiple fine-scale stratification rules, and particularly rules not supported by scientific data. For instance, there is no evidence, particularly in the summer, that lynx use specific topographic features preferentially. Lynx telemetry locations are not found adjacent to creeks or on flatter topography more than expectation within the study areas. Employing such rules in landscape stratification radically reduces the ability to infer the sample to the landscape (because so much of the landscape will be outside of the strata) without any direct evidence that the rules will increase the sampling efficacy.

Working in conjunction with other survey efforts

Hair snagging can be used to compliment other survey methods, such as snow tracking. For instance, if snow tracks were found in an area, particularly where lynx were thought to be absent, then placing a grid across the area would potentially validate the snow tracks. If individual DNA identification was performed on the samples, the addition of a hair survey could provide information concerning the number of lynx in the area. Using snow tracking as a pre-sampling method to determine grid placement in no way invalidates the protocol. In many areas this is a very sensible approach.

Non representative placement of transects, or even individual scent stations can sometimes provide useful information. For instance, if a lynx is known to exist within a specific drainage, one might want to specifically sample the drainage to try to determine whether the lynx is still present, or to obtain a sample of its DNA for research purposes. Similarly, scent stations can be used as a double-sampling method to directly validate snow tracks (as camera sets have been used in the past). These non-representative surveys, however, are entirely exterior to the National Survey Protocol, and we are doing no testing which can directly be used to indicate their efficacy. Additionally, as mentioned above, these data are extremely limited in their utility. They cannot, for instance, be used to infer anything about habitat relationships, the spatial extent of a local population, or the absence of lynx within a specific area. We therefore strongly recommend that these methods only be used to answer very specific questions in very specific areas. In most cases, laying a grid of transects across an area of interest will provide more usable information and is a better allocation of resources.

Selection of sites and station positions

Each survey consists of placing 25 sites within a predetermined study area. Place sites 2.0 mi apart in a grid fashion with the beginning of grid randomly located. Each site consists of one transect with 5 stations spaced 100 m apart and directed downhill. In areas lacking any measurable slope, transect direction can be random. Ideally, transect length is 400 m, however when transects encounter human development, natural openings, meadows, new clear-cuts, ponds or small lakes, breaks in transect may occur and increase the overall transect length. If these breaks cause overall transect length to exceed 1 km, part of the transect can be run uphill from the starting location (with the same rules concerning meadows, water etc.). If the overall transect length is still longer than 1 km, relocate the starting point to a location not further than ½ km of the original start, then repeat the protocol. If the relocated transect still encounters too much human development, open water, meadows, etc., then remove the site from the grid and locate the transect at the next closest grid location. It is best to accomplish this task using aerial photo and topographic maps prior to going into the field.

Figure 1. Example demonstrating placement of sites. Yellow line is area of interest. Red symbols are location of sites with 2-mile spacing.

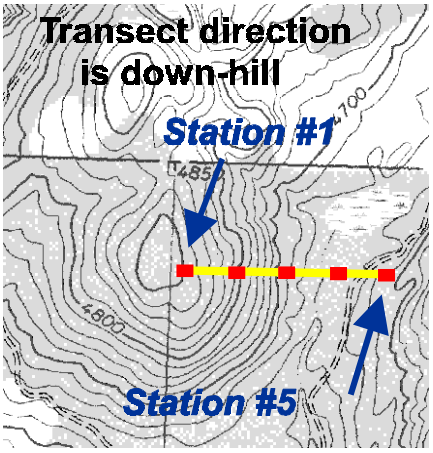


Figure 2. Transects are located downhill from the position of the site. Stations are 100 m apart.

Locate the 1st station at the point indicated by the 2x2 mile grid and locate the remaining stations (n=4) 100 m apart in a straight line and directed downhill from the 1st station. Only place stations in >10% tree cover (eye level and above). When you encounter natural openings, meadows, new clear-cuts, ponds or small

lakes that exceed 30 m in width while walking transects, do not include the distance across these open areas as part of the 100 m between transects (Fig 3). For example, stop counting your steps when you enter an open area, then continue your count when you exit the open area. When you encounter roads (or other developments) place station on the other side of the road and out-of-sight.

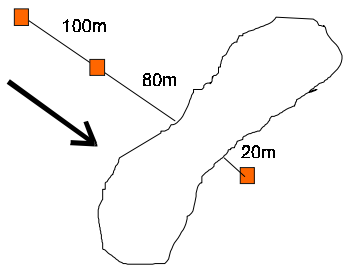


Figure 3. Example showing a transect crossing an open area. One hundred meters were measured between 1st and 2nd station; then 80 m was measured from 2nd station and edge of an open area. The open area was crossed without measuring distance and 20 m was measured on the far side to get to the 3rd station.

Keep good notes on the location of sites. Record directions to the site and the bearing of the transect line. If breaks or changes are made in the transect, make notes on these changes. Good records can save hours of searching when you revisit the site. If the site is close to a road, then flag where you leave the road to go to the site; this will help you when you return.

Construction of scent stations

Select a tree that is large enough to nail the hair snare onto; preferably one that has a good canopy, few low branches and shrubs. A good tree canopy will assist in keeping rain off the carpet pads. Clear all brush and branches 5 ft from the ground on the side of the tree where you will put the hair-snare. Your objective is to reduce or eliminate any obstacles for lynx to enter, rub on the hair-snare, and exit.

Nail a hair-snare onto the tree with the center of the hair-snare about 18 in from the ground. Your drywall hatchet is about 15 in long and can be used to make quick measurements in the field. Use 4 shingle nails – one at each corner of the pad. Hang a small carpet pad from a nearby tree branch (5 ft from the ground). The best placement is within sight of and at about 9 ft from the hair-snare – no more than 15 ft. First, select a tree branch that is at least 6 ft from the trunk of the tree, as high as you can reach and with few obstructions below the branch. You will probably need to cut brush and other branches that might tangle the pie-plate. Then, cut off the amount of wire that is needed. Push the wire through the center of the small carpet pad (2.5 X 2.5 in) provided in your kit using a twisting motion. Gently putting pressure on the wire

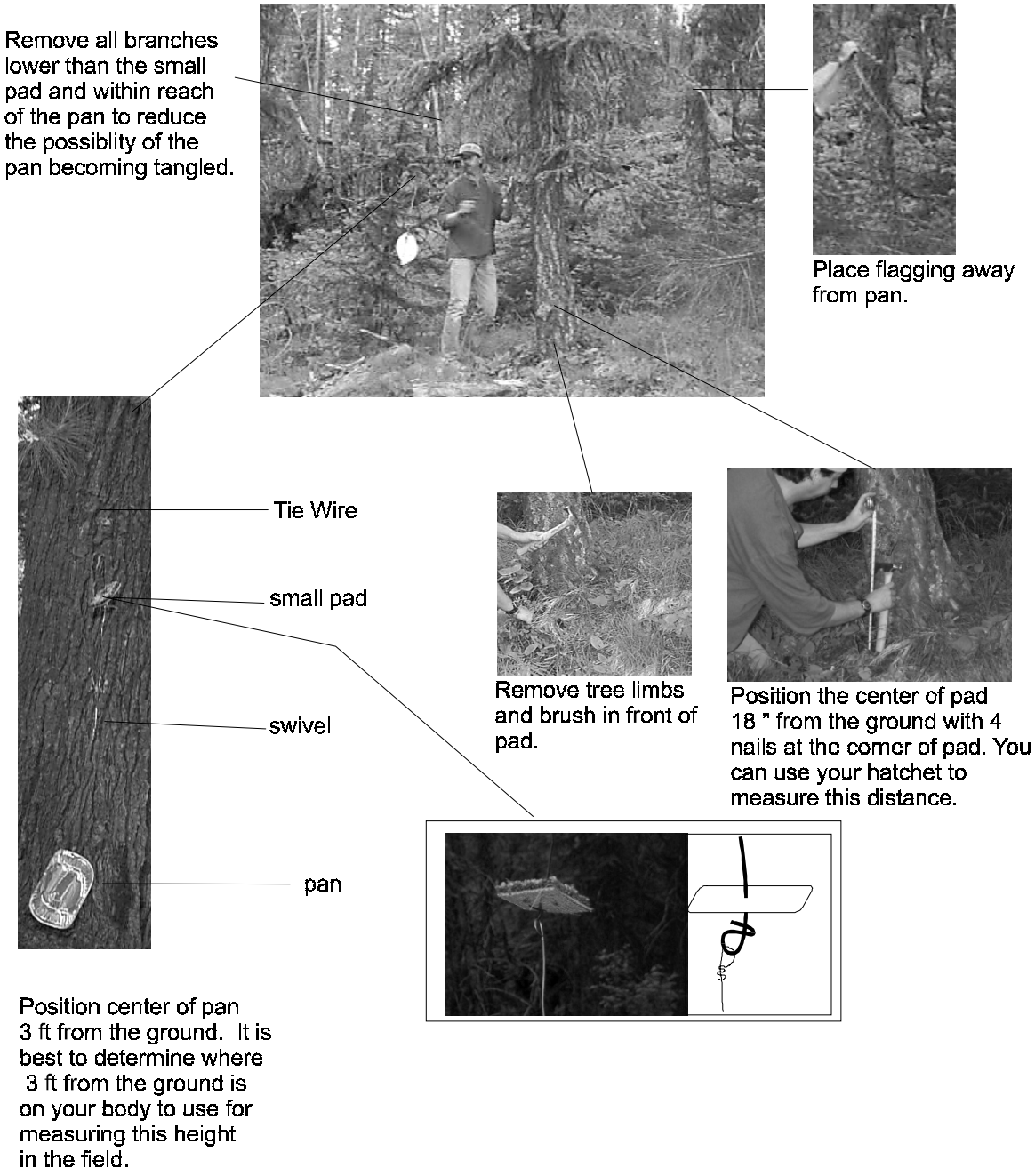


Figure 4. Construction of a scent station.

is better than brute force here because the wire can easily buckle. Twist the end of the wire in a single loop below the pad to hold the pad on the wire.

Hang an aluminum pie-pan (8-9 in diameter, center 3 ft from the ground) with the attached wire and swivel from the loop below the carpet pad. Make sure the wire loop below the carpet pad is closed so that the wire

on the pie-pan can not jump out of the loop. The pie-pan should already be shaped in an S-shape, but re-shape it if necessary. In addition, make sure that the wires are straight.

Clear branches away from the pie-pan so that it will not get tangled. Place flagging near the station so you can easily relocate the site. Do not hang flagging on the same branch as the pie-pan because the pie-pan will get tangled with the flagging. Using permanent marker, write the station number on the flagging and pie-pan. This will help in relocating stations. Often, the second station is relocated first and misidentified as the first station.

Baiting hair-snares

It is best to prepare hair-snares before going into the field. Place hair-snares and small carpet pads on a table. The lure is already pre-mixed. Thoroughly shake or stir the lure. Put 2 teaspoons (1/3 oz) of the lure on each hair-snare and 2 teaspoons of the lure on each small carpet pad. Spread out the lure on the pad as much as possible. Squeeze dried catnip between your thumb and fingers to help release the odor and sprinkle onto the hair-snare. The amount of dried catnip per pad is the maximum the pad can retain once it is lifted vertically, usually about 1 teaspoon. No dried catnip is put onto the small carpet pad that is hung from the tree branch.

Figure 5. Put 2 spoons of mixture on hair-snares and 2 spoons of mixture on small pads. Note that small pads are not shown in this picture.

Bait ingredients:
1:1: 6 ratio of propylene glycol, glycerine and beaver castorium. Six drops per oz of catnip oil was added to this mixture.

Habitat Measurements

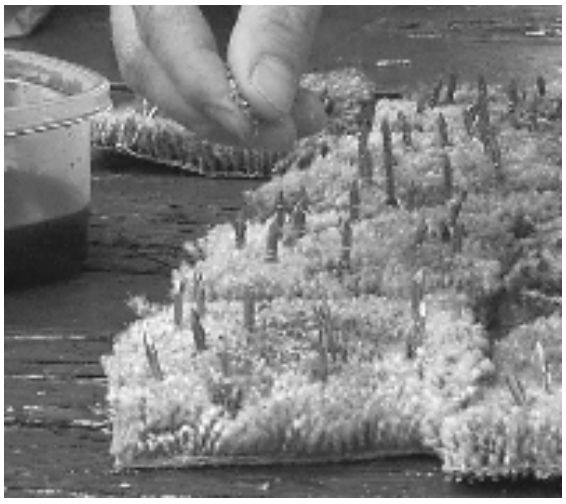


Figure 6. Sprinkle dried catnip over bait on hair-snares.

Record topographic features using a clinometer for slope and a compass for aspect. Make sure your compass has been adjusted for declination between true and magnetic north (declinations are provide on USGS topographic maps). Provide elevation at stations using the most accurate source available. Record over-story species and a visual estimate of over-story cover within approximately 30 ft of station. Likewise, provide understory shrub species and a visual estimate of shrub cover within approximately 30 ft of stations. Give a visually estimated dbh of a typical over-story tree species.

Safety Precautions

Bears are attracted to bait used at these stations and may become defensive by treating the bait as a food source. Extra precaution should be taken if possible bear encounters exist. Often bait gets on your hands. Avoid cleaning your hands on your cloths. Excess bait on your hands can be removed by rubbing them in dry dirt. Avoid getting bait on your pack. Garbage bags are provided to line the inside of your pack. In addition, 2-gal sealed containers are provided to transport baited hair-snares and pads in the field. Often bait will accumulate on the outside of the 2-gal containers. Occasionally clean the outside of these containers to avoid spreading the bait to other items in your pack. Do not transport other items besides hair-snares, pads and pie-pans in these 2 gal containers.

Checking stations for lynx hair

Check stations for lynx hair after a 2-week period. Take notes on tracks that you find at stations, condition of the station such as if pie-pan was tangled, or any other observations. Look for hair at a distance of 1 foot from the pad. Most hair is not noticeable at greater distances. You need to know what a carpet fiber look like so that you do not misidentify it as hair. If you intend to run stations longer than the initial 2-week period then re-bait station and check again after another 2-week period using the same procedures as was

used to set up the station except apply only 1 teaspoon of lure per pad instead of 2 teaspoons. When you find hair, put the pad in a plastic bag using surgical gloves and mark bag with the survey location, date, site and station number, and the name of observer. If you are running the stations for an additional 2-week period, replace the pad with a new one baited with 2 teaspoons of lure and catnip. After returning to an inside work area then remove as much hair as possible from the pad into a sealed plastic vial with desiccant using tweezers and clean surgical latex gloves. Be sure that you do not touch the hair with your fingers. Oils from your fingers will inhibit genetic analysis. While working with hair samples, maintain a clean environment such as to avoid cross-contamination of hair samples. Label samples with your initials, survey location, site number, station number and date. Keep the hair-snare in the plastic bag and store it and the sealed plastic vial in a cool dry place (IMPORTANT: do not freeze).

Send samples and data as soon as possible to:

Kevin McKelvey

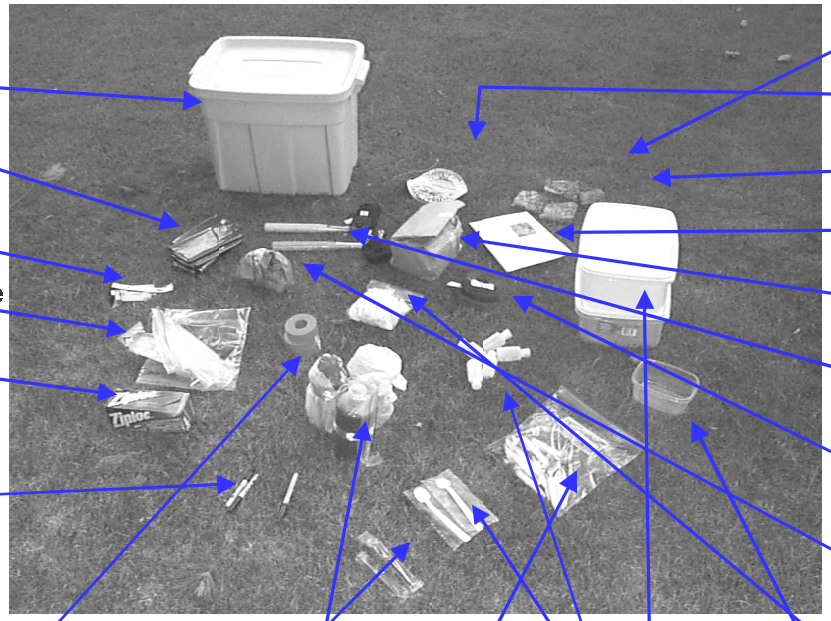
Rocky Mountain Research Station

800 E Beckwith Ave

Missoula, MT 59801

Samples do not need to be shipped with ice.

Supplies



Storage for vehicle

Garbage bags to line the inside of day packs

Nail pullers

Gallon zip locks for storage

Quart zip lock bags for storage of pads with hair

Permanent marker for marking flagging, plastic bags with hair-snare pads, and dessicant vials

3 rolls of flagging

Forceps for collecting hair from pads

Bait

dessicant vials

3 1/6 oz spoons

vials for carrying mixture into the field to rebait hair-snares

containers for carrying baited hair-snares and pads

150 hair-snares

150 pie-pans

150 small pads

protocol

dried catnip

2 shingle hammers with protection holsters

2 rolls of stove pipe wire for hanging pie-plates

4 lbs of 1 1/2 inch shingle nails

Surgical gloves for handling hair

Small container to assist with putting bait on pads

Note: Supplies are for protocol of 25 sites with extra (5 sites).